A waveguide LiNbO$_3$ electro-optic modulator has been demonstrated with a novel wave-coupling technique which greatly reduces phase-velocity mismatch. An 8-12 GHz version produces $48^\circ$ phase modulation with 126 mW of drive power. A 60 GHz version is being built.
**Features**

- Broadband - No Critical Phasing
- No Axial Attenuation Along Electrodes
- No Lead Parasitics

**Questions**

- Will it work?
- How efficient is RF coupling?
- Will it scale to mm-waves?
- Will antennas work on an interface?
**Schematic**

**Test Setup**

**Scanning Fabry-Perot**

**Sidesbands @ 1150 GHz**

**X5 Results**

**Modulation vs Angle**

**Conclusion**

- **Demonstrated antenna-coupled X-band prototype phase modulator**
- Frequency response agrees with theoretical model
- Angle-dependence agrees with phase-velocity-matching picture
- Concept scalable to 508 GHz
- Fabricating second prototype for 60 GHz

**MM-Wave Results**: 24 October

25mm φ-modulator = 30 antennas

P_{in} = 100 mW @ 63.4 GHz